ASTER Scheduling Prioritization Function

JPL

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The concepts presented herein were developed over the past several years, by JPL Aster Operations Support Task personnel, as techniques for maximizing ASTER data collection and operations efficiency.

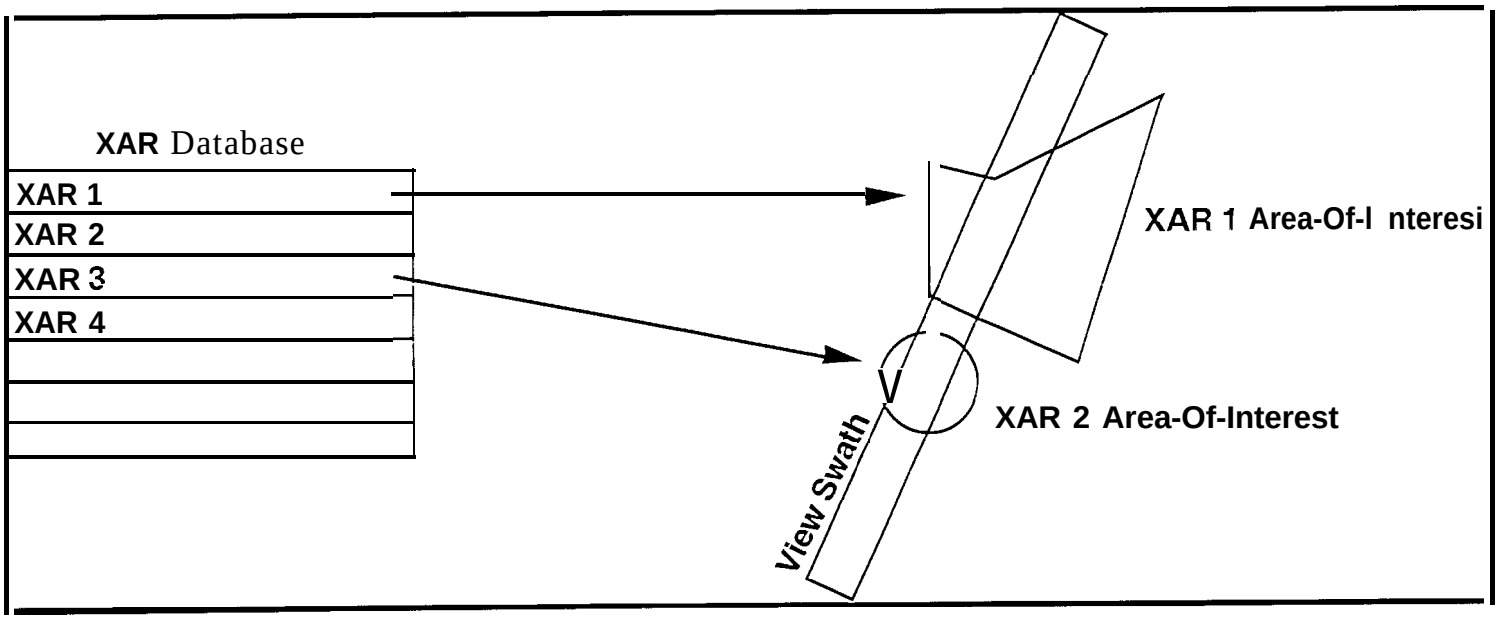
ASTER Scheduling Prioritization Function

- **ASTER Schedules are generated by an automated Scheduling System**
- **This scheduler will generate psuedo-optimal schedules based on a priority scheme**
- **This priority scheme is controlled by the Science Team**

Scheduler Program Flow

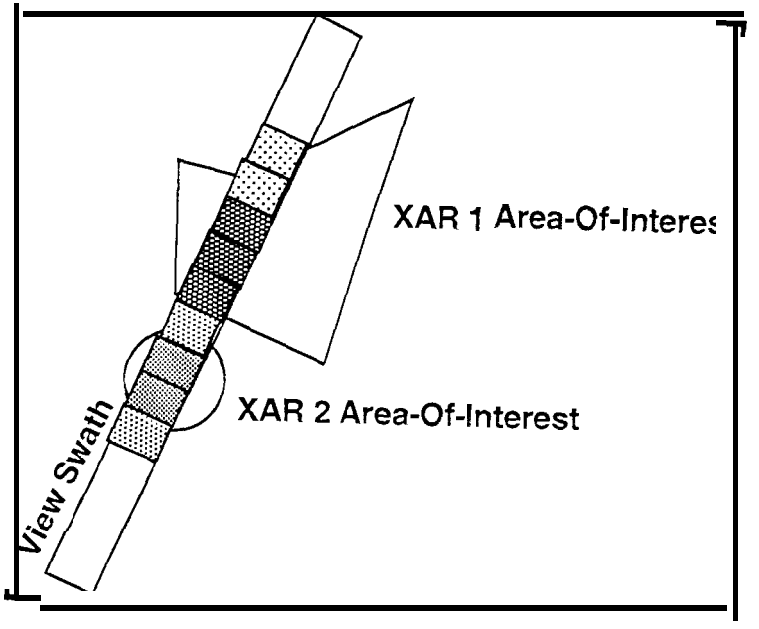
(For each orbit & each view swath)

1. Generate Observation Opportunities



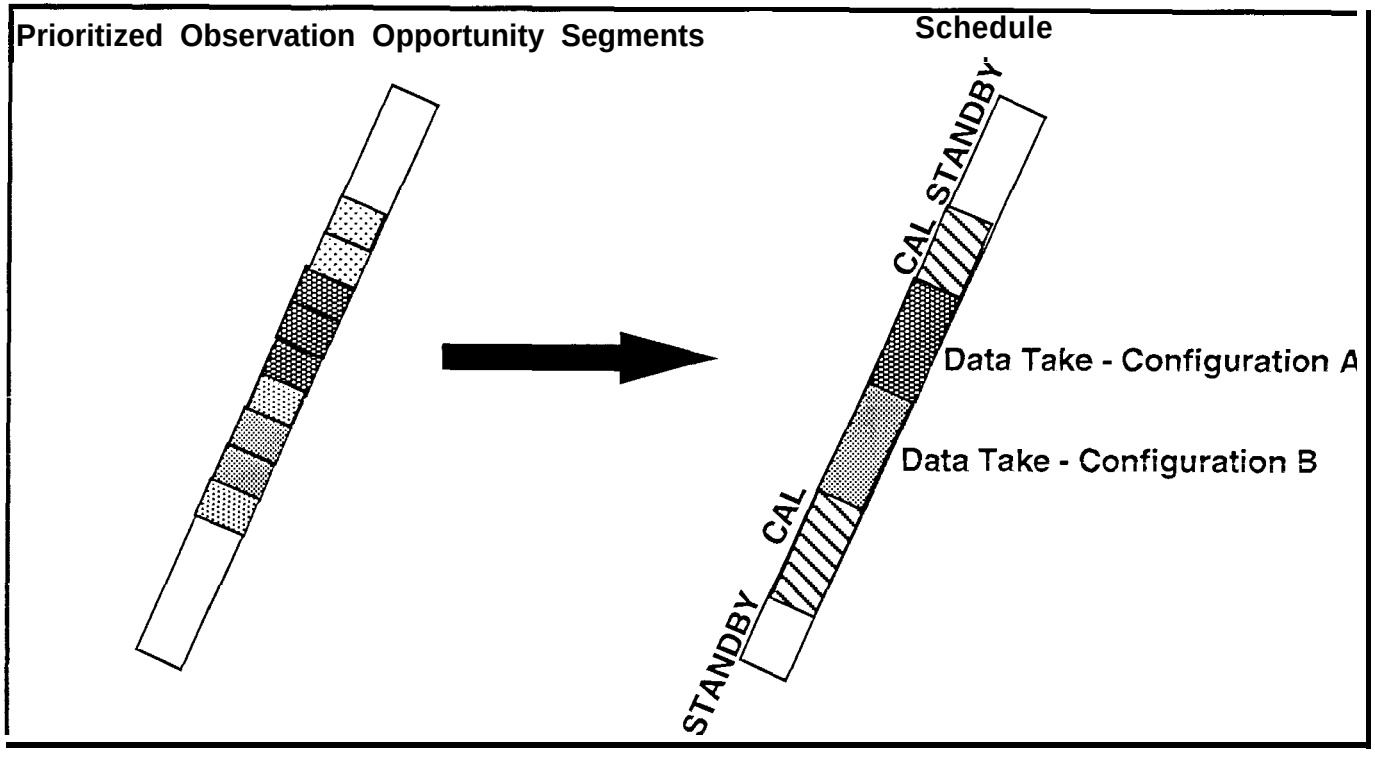
Program Flow

2. Prioritize Observation Opportunities



Program Flow

3. Generate Schedule



- Priority values are assigned to Earth-fixed grid cells which are smaller than a scene
- Priority score for an orbital view swath is the sum of all of the cells in that swath
- Scheduler then chooses the single view swath with max priority score

Prioritization Process

- **In each map grid cell, compute Priority Scores for each XAR, using a Priority Function**
- **In each map grid cell, compute priority of each possible instrument configuration by summing priorities of each XAR which requested each particular configuration**
  - **Some XARS request common configurations**
  - **Some XARS request configurations which overlap with other XARS**
- **Final priorities represent the value of being in each particular instrument configuration at each grid cell**

Priority Function

Inputs:

- **Requester (XAR) information**
- **Scheduling system internal information (time-variable)**

output:

- **Numerical priority “score” for observing data for particular XAR in a particular map grid cell**

Priority Function Inputs - Requester Information
(From “Functional Requirements on Mission Operations”)

- Science investigation classification
- Requester affiliation
- Areal coverage requirements (size, amount of data, minimum acceptable coverage, fragmentation)
- observation time requirements (acquisition window, start/end of acceptable data)
- Observation frequency requirements (acquisition interval)
- number of revisits
- associated observation requirements (relationship between observations)
- acceptable cloud coverage
- Implementation urgency
- Coordination with other science or engineering activities
- observation alternatives/contingencies
- Desired vs. Acceptable data
- Non-nominal pointing requirements
- Minimum number of revisits for successful completion. (For example, 8 out of 12 monthly observations over 1 year)

Priority Function Inputs - Scheduling System Internal Information

- Number of future opportunities (before request expires)
- Amount of data already successfully acquired for this xAR
- number of previous opportunities
- Number of unsuccessful attempts (scheduled but not obtained)
- proportional gain in desired data (increase in coverage or observation repetition)
- Predicted cloud cover (from climatology and/or forecasts)
- The length of time for which an observation has been scheduled in the STS and LTS

Priority Function

- The parameters described on previous page can be combined in various mathematical functions
- The optimal form of this function is TBD
- Preliminary thinking resulted in a polynomial (next page)
- This function will certainly change drastically

Preliminary Possible Potential Candidate Strawman Draft Priority Function

$$
\begin{aligned}
\text{Priority} = & \frac{(\text{Probability of cell cloud free within user limit}) + C1}{C2} \\
& * \{ K1 * \text{Science Class Weight} \\
& + K2 * \text{Investigator Affiliation} \\
& + K3 * \frac{\text{Target size}}{\text{No. remaining opportunities}} \\
& + K4 * \frac{\text{Grid cell area}}{\text{Remaining target area}} \\
& + K5 * \frac{\text{Target size}}{\text{Amount of target already observed} + C3} \\
& + K6 * \frac{\text{No. remaining requested revisits}}{\text{Remaining time in acquisition window} + C4} \\
& + K8 * \frac{\text{No. remaining requested revisits}}{\text{No. remaining opportunities}} \\
& + K9 * \text{No. previous succesful attempts}
\end{aligned}
$$

$$+ K10 * \text{Total previous attempts}$$

$$+ K7 * \left\{ \text{\# elapsed days which observation has been in schedule} \right\}$$

ASTER Closed-Loop Scheduling Adjustment Concept